Claims

We claim:

1. A first-side optical data storage disk comprising:

a circular substrate having first and second principal surfaces;

a first metal/alloy layer overlying said first principal surface of said substrate;

a first transparent layer overlying said first metal/alloy layer; and

a second metal/alloy layer overlying said first transparent layer, wherein each of said metal/alloy layers is adapted to be read by a laser beam that does not pass through said substrate.

2. The first-side optical data storage disk of Claim 1 wherein said first principal surface of said substrate comprises premastered data which includes a series of pits and/or bumps, said first metal/alloy layer conforming to the shape of said pits and/or bumps.

3 The first-side optical data storage disk of Claim 2 wherein the transmissivity of said second metal/alloy layer at the wavelength of said laser beam is greater than 10%.

4. The first-side optical data storage disk of Claim 2 wherein said first metal/alloy layer contains a writeable area.

5. The first-side optical data storage disk of Claim 1 wherein said first metal/alloy layer contains a writeable area.

6. The first-side optical data storage disk of Claim 5 wherein the transmissivity of said second metal/alloy layer at the wavelength of said laser beam is in the range of 25% to 50%.

7. The first-side optical data storage disk of Claim 5 wherein said second metal/alloy layer contains a writeable area.

8. The first-side optical data storage disk of Claim 1 wherein said second metal/alloy layer comprises premastered data which includes a series of pits and/or bumps.

9. The first-side optical data storage disk of Claim 1 wherein said second metal/alloy layer contains a writeable area.

10. The first-side optical data storage disk of Claim 1 wherein said first metal/alloy layer comprises aluminum.

11. The first-side optical data storage disk of Claim 10 wherein said second metal/alloy layer comprises SbInSn.

12. The first-side optical data storage disk of Claim 1 comprising:

a third metal/alloy layer underlying said second principal surface of said substrate;

a second transparent layer underlying said third metal/alloy layer; and

a fourth metal/~~ally~~ alloy layer underlying said second transparent layer.

13. The first-side optical data storage disk of Claim 12 wherein said second principal surface of said substrate comprises premastered data which includes a series of pits and/or bumps in said substrate, said third metal/alloy layer conforming to the shape of said pits and/or bumps.

14. The first-side optical data storage disk of Claim 13 wherein said third metal/alloy layer contains a writeable area.

15. The first-side optical data storage disk of Claim 12 wherein said second metal/alloy layer comprises premastered data which includes a series of pits and/or bumps.

16. The first-side optical data storage disk of Claim 15 wherein said second metal/alloy layer contains a writeable area.

17. The first-side optical data storage disk of Claim 13 wherein said second metal/alloy layer contains a writeable area.

18. The first-side optical data storage disk of Claim 1 wherein said substrate comprises polycarbonate.

19. The first-side optical data storage disk of Claim 1 wherein said first transparent layer comprises a photopolymer resin.

20. The first-side optical data storage disk of Claim 1 wherein said first transparent layer comprises a curable polymer.

21. The first-side optical data storage disk of Claim 1 wherein said first transparent layer comprises a UV curable material.

22. The first-side optical data storage disk of Claim 1 wherein said substrate has a thickness in the range of 200 to 1000 μm.

23. The first-side optical data storage disk of Claim 22 wherein said substrate has a thickness of approximately 500 μm.

24. The first-side optical data storage disk of Claim 1 wherein said first transparent layer has a thickness in the range of 15 to 200 μm.

25. The first-side optical data storage disk of Claim 24 wherein said first transparent layer has a thickness of approximately 50 μm.

26. The first-side optical data storage disk of Claim 1 comprising a protective coating between said first metal/alloy layer and said first transparent layer.

27. The first-side optical data storage disk of Claim 1 comprising a protective coating overlying said second metal/alloy layer.

28. The first-side optical data storage disk of Claim 27 comprising a second protective coating underlying said fourth metal/~~ally~~ alloy layer.

29. The first-side optical data storage disk of Claim 28 wherein said protective coating is exposed to the atmosphere.

30. The first-side optical data storage disk of Claim 1 wherein the reflectivity of said first and second metal/alloy layers at the wavelength of said laser beam is at least 15%.

31. The first-side optical data storage disk of Claim 1 wherein said disk is less than 50 mm in diameter.

32. The first-side optical data storage disk of Claim 31 wherein said disk is at or below 32 mm in diameter.

33. The first-side optical data storage disk of Claim 1 wherein said first metal/alloy layer is a read-only layer and said second metal/alloy layer comprises a

writeable area, said writeable area comprising a code which permits access to a portion of data recorded on the first metal/alloy layer.

34. The first-side optical data storage disk of Claim 33 wherein said code permits access to a portion of data recorded on the second metal/alloy layer.

35. A method of reading data from the first-side optical data storage disk of Claim 1 comprising:

directing a laser beam such that the laser beam is partially reflected from and partially transmitted through the second metal/alloy layer:

detecting a first portion of the laser bean that is reflected from the first metal/alloy layer; and

detecting a second portion of the laser beam that is reflected from the second metal alloy layer.

36. The method of Claim 35 wherein the laser beam has a wavelength in the range of 350 to 450 nm.

37. The method of Claim 36 wherein the laser beam has a wavelength of approximately 400 nm.

38. The method of Claim 35 wherein the laser beam has a wavelength of approximately 650 nm.

39. A method of reading data from and/or writing data to the first-side optical data storage disk of Claim 1 comprising:

using a laser beam to read data from and/or write data to said first metal/alloy layer; and

using a laser beam to read data from and/or write data to said second metal/alloy layer

wherein said laser beam does not pass through said substrate.

40. The method of Claim 39 comprising detecting which of said metal/alloy layers is being read.

41. The method of Claim 40 wherein detecting which of said metal/alloy layers is being read comprises reading a data pattern written on one of said layers, said data pattern indicating the layer on which said data pattern is written.

42. The method of Claim 41 wherein said data pattern is premastered.

43. The method of Claim 41 wherein said data pattern was written on said layer using a laser beam.

44. The method of Claim 40 wherein detecting which of said metal/alloy layers is being read comprises detecting the reflectivity of one of said metal/alloy layers.

45. The method of Claim 40 wherein detecting which of said metal/alloy layers is being read comprises detecting a feature of a focus servo response curve.

46. The method of Claim 39 wherein the laser beam has a wavelength in the range of 350 to 450 nm.

47. The method of Claim 46 wherein the laser beam has a wavelength of approximately 400 nm.

48. The method of Claim 39 wherein the laser beam has a wavelength of approximately 650 nm.

49. A method of manufacturing a first-side dual-layer optical data storage disk comprising:

providing a substrate having data premastered on at least a first principal surface of said substrate;

depositing a first metal/alloy layer over said first principal surface;

depositing a layer of a curable liquid over said first metal/alloy layer;

embossing a data pattern on said layer of curable liquid;

curing and solidifying said layer of curable liquid; and

depositing a second metal/alloy layer over said solidified layer of curable liquid.

50. The method of Claim 49 wherein embossing a data pattern on said curable liquid comprises applying a transparent stamper to said liquid and directing UV light onto said liquid.

51. The method of Claim 50 wherein directing UV light onto said liquid comprises directing UV light through said transparent stamper.

52. The method of Claim 49 wherein depositing a second metal/alloy layer comprises sputtering.

53. The method of Claim 49 wherein depositing a second metal/alloy layer comprises evaporation.

54. The method of Claim 49 wherein data is premastered on a second principal surface of said substrate, said method comprising:

depositing a third metal/alloy layer under said second principal surface;

depositing a second layer of a curable liquid under said first metal/alloy layer;

embossing a data pattern on said second layer of curable liquid;

curing solidifying said second layer of curable liquid; and

depositing a fourth metal/alloy layer under said layer of curable liquid.

55. The method of Claim 49 wherein the laser beam has a wavelength in the range of 350 to 450 nm.

56. The method of Claim 55 wherein the laser beam has a wavelength of approximately 400 nm.

57. The method of Claim 49 wherein the laser beam has a wavelength of approximately 650 nm.